

600mA* PWM/VFM Step-down DC/DC Converter with Synchronous Rectifier

The RP504x Series are low supply current CMOS-based PWM/VFM step-down DC/DC converters with synchronous rectifier. RP504K/L can be switched from two control types by inputting signal to the MODE pin - forced PWM control or PWM/VFM auto switching control in which mode automatically switches to high-efficiency VFM mode in low output current. (RP504N Series can be selected from forced PWM control or PWM/VFM auto switching control.) RP504x includes a soft start circuit, an under-voltage lockout circuit (UVLO), and a latch protection circuit. By simply using an inductor and capacitors as external components, a high-efficiency step-down DC/DC converter can be easily configured. The small inductor (2.2μH) and output capacitor (4.7μF) can be used by the switching of 2.25MHz. In addition to SOT-23-5 and DFN1616-6B packages, a 1.2mm × 1.6mm DFN(PLP)1216-6B package is also available.

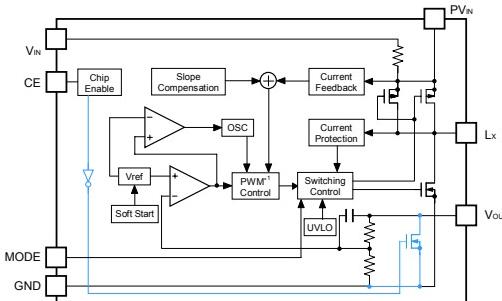
FEATURES

- Supply Current (I_{DD1}) Typ. 400μA ($V_{IN}=V_{CE}=5.5V$, $V_{OUT}=V_{SET} \times 0.8$)
- Supply Current (I_{DD2}) Typ. 25μA ($V_{IN}=V_{CE}=V_{OUT}=5.5V$)
- Standby Current ($I_{Standby}$) Max. 5μA ($V_{IN}=5.5V$, $V_{CE}=0V$)
- Input Voltage Range (V_{IN}) 2.3V to 5.5V
- Output Voltage Range (V_{OUT}) 0.8V to 3.3V (internally fixed)
- Output Voltage Accuracy ± 1.5%
- Output Current (I_{OUT}) 600mA*
- Oscillator Frequency (f_{osc}) 2.25MHz
- Oscillator Maximum Duty Cycle (Maxduty) Min. 100%
- UVLO Detect Voltage (V_{UVLO}) Typ. 2.0V
- Soft Start Time (t_{start}) Typ. 0.15ms
- Coil-current Limit Circuit Current limit Typ. 900mA
- Latch Protection Circuit Delay time for protection Typ. 1.5ms
- Auto-Discharge Function D Version
- MODE pin "H": PWM/VFM auto switching, "L": forced PWM (RP504N does not have MODE pin)
- Packages DFN(PLP)1216-6F, DFN1616-6B, SOT-23-5

*) This is an approximate value, because output current depending on conditions and external parts.

BLOCK DIAGRAM

RP504L/K



*1) MODE="H": PWM/VFM auto switching, MODE="L": forced PWM
Blue Line : only RP504Kxx1D, RP504Lxx1D

SELECTION GUIDES

Halogren Free	Package	Q'ty per Reel	Part No.
(H/F)	DFN(PLP)1216-6F	5,000 pcs	RP504Lxx1*-E2
(H/F)	DFN1616-6B	5,000 pcs	RP504Kxx1*-TR
(H/F)	SOT-23-5	3,000 pcs	RP504Nxx1\$-TR-FE

xx : Specify the output voltage within the range of 0.8V (08) to 3.3V (33) in 0.1V steps.

PACKAGES (Top View)

DFN(PLP)1216-6F	DFN1616-6B	SOT-23-5
1 VIN	1 CE	1 VOUT
2 MODE	2 MODE	2 GND
3 CE	3 V _{IN}	3 L _x
4 V _{OUT}	4 L _x	4 V _{IN}
5 GND	5 GND	5 CE
6 L _x	6 V _{OUT}	

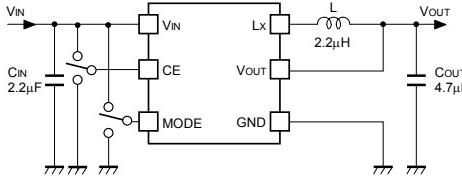
*) The tab is substrate level (GND).

APPLICATIONS

- Power source for battery-powered equipment
- Power source for hand-held communication equipment, cameras, and VCRs
- Power source for compact HDD

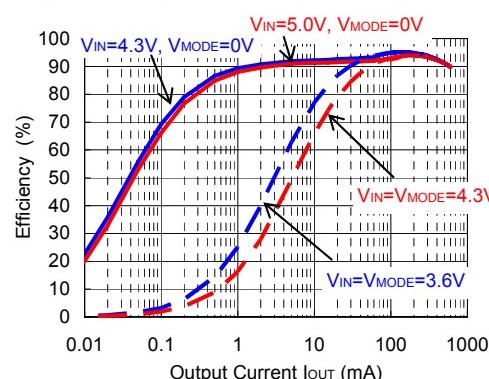
TYPICAL APPLICATION

RP504L/K



L : MIPSZ2520D2R2, MIPS2520D2R2 (FDK), MLP2520S2R2M, VLS252010T-2R2M (TDK), CKP2520-2R2M (TAIYO YUDEN)
CIN : 2.2μF: C1608JB0J225K (TDK), 2.2μF×2: C1005JB0J225K (TDK), JMK105BJ225MV (TAIYO YUDEN)
COUT : 4.7μF: C1005X5R0J475M (TDK), JMK105BJ475MV (TAIYO YUDEN)
C1608JB0J475K (TDK), GRM155B30J475KE18 (MURATA)

TYPICAL CHARACTERISTIC

RP504x (V_{OUT}=3.3V) Efficiency vs. Output Current

600mA PWM/VFM Step-down DC/DC Converter with Synchronous Rectifier

RP50x Series 600mA

Step-down DC/DC Converter Comparison

	RP504x Series	RP500x Series	RP502x Series	RP503x Series
Control	PWM/VFM auto switching / Forced PWM (It can be switched by MODE pin)	PWM/VFM auto switching / Fixed PWM	PWM/VFM auto switching / Fixed PWM	PWM/VFM auto switching
Output Current *1	600mA	600mA	600mA	600mA
Supply Current (PWM Mode)	Typ. 400μA	Typ. 400μA	Typ. 750μA	-
Supply Current (VFM Mode)	Typ. 25μA	Typ. 100μA	Typ. 180μA	Typ. 20μA
Supply Current (Standby)	Max. 5μA	Max. 5μA	Max. 5μA	Max. 5μA
Input Voltage Range	2.3V to 5.5V	2.55V to 5.5V	2.5V to 5.5V	2.5V to 5.5V
Output Voltage Range	0.8V to 3.3V	1.1V to 3.3V	0.8V to 3.3V	0.8V to 2.5V
Oscillator Frequency	Typ. 2.25MHz	Typ. 1.2MHz	Typ. 3.3MHz	Typ. 2MHz
Output Voltage Accuracy	±1.5%	±1.5%	±1.5%	±1.5%
Oscillator Maximum Duty Cycle	Min.100%	Min.100%	Min.100%	Min.100%
UVLO Detect Voltage	Typ. 2.0V	Typ. 2.2V	Typ. 2.2V	Typ. 2.2V
Soft-start Time	Typ. 0.15ms	Typ. 0.12ms	Typ. 0.12ms	Typ. 0.15ms
Latch Protection Circuit (Protection Delay Time)	Typ. 1.5ms	Typ. 1.5ms	Typ. 1.5ms	Typ. 1.5ms
Coil-current Limit Circuit	Typ. 900mA	Typ. 900mA	Typ. 900mA	Typ. 800mA
Package	DFN(PLP)1212-6F DFN1616-6B SOT-23-5*4	WLCSP-6-P2*2 DFN1616-6*3 DFN(PLP)1820-6 SOT-23-6W	WLCSP-6-P2*2 DFN1616-6*3	WLCSP-6-P2*2 DFN1616-6*3 SOT-23-5*4
Version	<p>DFN Package A Version With MODE pin, without auto-discharge function D Version With MODE pin, with auto-discharge function SOT Package B Version PWM/VFM auto switching, without auto-discharge function C Version Fixed PWM, without auto-discharge function</p>	<p>1 Version PWM/VFM auto switching, without auto-discharge function 2 Version Fixed PWM, without auto-discharge function 3 Version PWM/VFM auto switching, with auto-discharge function (except for the DFN package) 4 Version Fixed PWM, with auto-discharge function</p>	<p>1 Version PWM/VFM auto switching, without auto-discharge function 2 Version Fixed PWM, without auto-discharge function 3 Version PWM/VFM auto switching, with auto-discharge function 4 Version Fixed PWM, with auto-discharge function</p>	<p>1 Version PWM/VFM auto switching, without auto-discharge function 2 Version PWM/VFM auto switching, with auto-discharge function</p>

*1) This is an approximate value, because output current depending on conditions and external parts.

*2) RP500Z, RP502Z, and RP503Z are pin-compatible *3) RP500L, RP502L, and RP503L are pin-compatible *4) RP503N and RP504N are pin-compatible

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■ Ricoh presented with the Japan Management Quality Award for 1999.

Ricoh continually strives to promote customer satisfaction, and shares the achievements of its management quality improvement program with people and society.



■ Ricoh awarded ISO 14001 certification.

The Ricoh Group was awarded ISO 14001 certification, which is an international standard for environmental management systems, at both its domestic and overseas production facilities. Our current aim is to obtain ISO 14001 certification for all of our business offices.



Ricoh completed the organization of the Lead-free production for all of our products. After Apr. 1, 2006, we will ship out the lead free products only. Thus, all products that will be shipped from now on comply with RoHS Directive.

<http://www.ricoh.com/LSI/>

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